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TEXT STRUCTURES AFFECT READING SPEED

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ABSTRACT

The objective of this study was to investigate how the text structures affect reading speed in the same participants. Two types of text structures were used. The first text structure (TS1) had a total of 84 words that formed by 14 separate sentences with 6 words in each sentence (3-words per line). The second text structure (TS2) was written as 100-words passage with 10 continuous sentences. The average words in TS2 was 3 to 15 words per sentence. The sentences were constructed in Malay language and words selected from Malay textbook under The Malaysia Ministry of Education (MMOE). Twenty-five participants were asked to read aloud both text structures at random. Time to complete both texts was measured with stopwatch and recorded using audiotape. The error was noted in recording sheet if there were any omission, repeated, added or misread of word. Reading speed was calculated as words per minute (wpm). Mean reading speed in for TS1 was found to be faster than TS2 ($t=10.61$, $p<0.01$). In conclusion, text structures might affect reading speed among Malay-native speakers. Therefore, it was importance to consider about the text structure in designing the reading material for evaluation and monitoring the reading and vision rehabilitation.

Keywords: *reading speed, Malay sentence, text structure*

INTRODUCTION

Reading chart is importance as tools for evaluating the reading performance. The value of reading speed can be used to predict the reading performance after surgical treatment and vision rehabilitation (Rubin, 2013). Reading speed could be quantified as correct words divided with time taken to read text structure in words per minute (Legge, Rubin, Pelli & Schleske, 1985). The available reading chart consisted of sentence (Wolffsohn & Cochrane, 2000) and passages (Trauzettel-Klosinski & Dietz, 2012). Some more words and others were constructed with fewer word. The constructions of text structure are based on lexical difficulty and syntactical structure of sentence such as words, syllables and characters (Brussee, van Nispen & van Rens, 2014).

Reading chart that used TS1 and TS2 text structure had different purposes for clinical-based practice. Reading chart with TS1 usually had fewer word which are developed for measuring reading acuity, reading speed and critical print size (Virgili et al., 2004). However, reading chart using TS2 had more words and useful in diagnose reading disorders such as neurological and developmental problem, monitoring low vision rehabilitation, documentation after interventions treatment such as for post-multifocal intraocular lens implantation (Trauzettel-Klosinski & Dietz, 2012)

Reading charts using fewer word of TS1 are The Minnesota Reading Acuity (MNRead) (Mansfield, Legge & Bane, 1996), Radner Reading Chart (RRC) (Stifter et al., 2004) Malay reading chart (Buari, Chen & Musa, 2014) and The Practical Near Acuity Chart (PNAC) (Wolffsohn & Cochrane, 2000). Then, few studies have conducted and developed reading charts using more words of TS2, for example The New International Reading Speed Texts (IReST) (Hahn et al., 2006; Trauzettel-Klosinski & Dietz, 2012), Nederlanders reading test (NED) (Brussee, van Nispen, Klerkx, Knol & van Rens, 2015) and "Zuercher Reading Test" (ZRT) (Wolfgang Radner et al., 2002). The average words of reading charts with TS1 are ranges from 3 to 14 words per sentences (Buari et al., 2014; Legge, Ross, Luebker & Lamay, 1989; W. Radner & Diendorfer, 2014; Wolffsohn & Cochrane, 2000) while reading charts with TS2 usually are more than 14 words per sentences (Hahn et al., 2006; Trauzettel-Klosinski & Dietz, 2012). The constructed

reading charts with TS1 was easy to control the sentence optotypes such as number of words, syllables and number of characters (Buari et al., 2014; Calossi, Boccardo, Fossetti, & Radner, 2014; Mataftsi et al., 2013). While, with TS2, it was difficult to control the syllable and number of characters to be homogenous because of language barrier and contextual meaning (Trauzettel-Klosinski & Dietz, 2012).

There was comparison in terms of reading speed between reading chart that used TS2 and TS1. The maximum reading speed of ZRT was 76.4 words per minute (wpm) slower than the RRC. The number of words affected the reading speed between ZRT and RRC even lexical difficulty was the same (Wolfgang Radner et al., 2002). Reading speed between Nederlanders reading test (NED) and IReST was differed by 32 wpm (Brussee et al., 2015). Both charts used TS2 which NED has 61 words while IReST has 141 words. NED chart used literary level of difficulty, which was higher lexical difficulty while IReST used school level of reading materials, which had lower lexical difficulty. This showed that even IReST has more number of words; the reading speed was higher than NED due to lower lexical difficulty. The difference in number of words and lexical difficulty might be a factors that contributed in differences in reading speed (Brussee et al., 2015). Even though reading charts using TS1 and TS2 were found highly correlated to each other but the purpose of the reading charts were different. Reading charts using TS1 was more easy and suitable to be used in routine clinical practice as well as single reading evaluation due to quick and easy to administered (W. Radner & Diendorfer, 2014).

Various reading charts using TS1 and TS2 have been translated into different languages. It is beneficial if the reading performance is tested using reading chart with the same language as native speaker. Reading charts should be designed to match the content, words difficulty and linguistic complexity. However, due to language characteristics, reading charts would be different with number of words, syllables and characters that causes variability and significant difference of reading speed (Hahn et al., 2006; Trauzettel-Klosinski & Dietz, 2012). Thus, the purpose of this study is to compare reading speed between TS1 and TS2 in Malay language among Malay native-speaker.

METHOD

Reading Stimuli

The text structures were constructed in Malay language. The text structures were selected from Malay Primary School textbooks used by the children in school under Malaysia Ministry of Education (MMOE). To construct the first text structure, TS1, a pool of 14 sentences were developed. The TS1 consisted of 6 words per sentence.

TS1 comprised of characters that range from 31 to 35. The sentence was arranged in 2 lines with 3 words in each line. There was a line gap between each sentence in TS1. Therefore, this gave the total number of words for all sentences in TS1 were 84 words. Meanwhile, second text structure, TS2, was developed in 10 continuous sentences range from 3 to 15 words per sentences. The number of characters for each word in sentences of TS2 with more words ranged from 23 to 99. The TS2 was arranged in a block alignment with 4 lines. The total number of words for TS2 was 100-words. The Figure 1 shows the sample of text structure.

The text structure used Ariea font type. The text structures were developed as easily readable with lower lexical difficulty. It was printed on separated white A4 paper and covered with white blank paper to avoid pre-reading before reading speed measurement.

Kamu perlu balik

(a) *Kita mesti kembali*
ke kampung ini

(b) *Lif ialah prasarana yang disediakan untuk kemudahan orang ramai. Kita hendaklah memastikan kemudahan ini digunakan dangan berhemah. Lif sering menjadi mangsa vandalisme sehingga menyebabkan lif gagal berfungsi dengan baik. Sebelum memasuki lif pastikan penumpang di dalam lif keluar dahulu. Kita hendaklah mengamalkan sikap budiman dengan mendahulukan orang yang lebih memerlukan.*

Figure 1: (a) First text structure, TS1 (b) Second text structure, TS2

Reading Speed Measurement

The printed text structures were placed on reading stand at 45° with testing distance at 40 cm. Twenty-five participants was asked to read sentences in random order. The participants were asked to read aloud the text structure at normal rate. Time of reading was measured with stopwatch started at first words of text structure. The reading evaluation was recorded using audiotape. Reading error was noted on recording sheet. Reading error was counted as omission, repeated, added or misread the words during reading. Reading speed was quantified as correct words divided with time taken to read text structure in words per minute.

Participants

Twenty-five normal young university participants recruited for each testing (mean age: 21.36±1.99 years; range age 19-25 years) in this study with informed consent. Participants that able to read and speak in Malay were recruited. Inclusion criteria were among those who are having best corrected distance visual acuity of 6/9 or better. The measurement of distance visual acuity was performed using Bailey-Lovie LogMAR chart with testing distance at 4 m. The participants should not have previous history of eye pathologies and binocular vision problem, which can influence the results of this study. The study was adhered the Declaration of Helsinki and approved by the Research Ethic Committee of Universiti Teknologi MARA (approval code: 600-FSK (PT.5/2)).

STATISTICAL ANALYSIS

Statistical analyse was performed using Statistical Package for Social Sciences (SPSS) version 21.0. The mean and standard deviation of reading speed with TS1 and TS2 were calculated. Independent t-test was used to compare reading speed between TS1 and TS2. The significant level was set at 0.05.

RESULTS

TS1 showed reading time of 743.0s with 1.0 ± 1.0 error made by participants. Reading time for TS2 was 992.8s and the error was 0.5 ± 0.5 error. The mean reading speed of the TS1 was 208.6 ± 21.2 words per minute (wpm) whereby 153.1 ±15.3 wpm was found in those who reading the TS2. Figure 1 showed the boxplot of mean reading speed of both text structures.

Comparison of reading speed between TS1 was found significantly higher than with TS2. It was proved by independent sample t-test with t (df =48) =10.61, $p<0.01$.

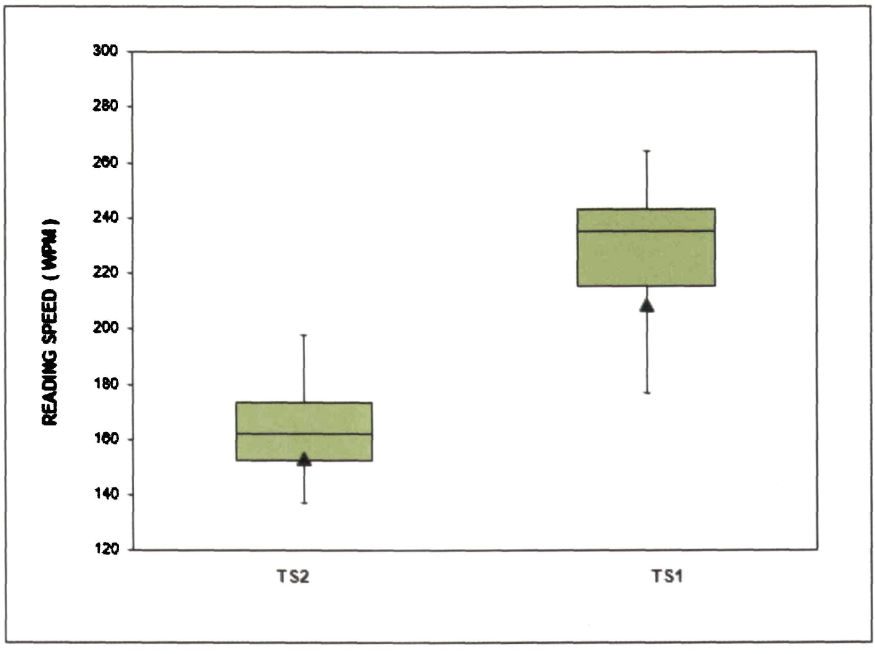

Figure 2: Comparison of mean reading speed between TS2 and TS1

DISCUSSION

Reading time for TS1 and TS2 were 743.0s and 992.8s respectively. Shorter time duration was taken to read the TS1 by 249.76s than TS2. Then, after calculated the reading speed, mean reading speed of TS1 was 208.6 ± 21.2

words per minute (wpm) while the TS2 were found to be 153.1 ±15.3 wpm. This showed mean reading speed with TS1 was 55.5 wpm faster compared to young adult read the TS2. However, reading speed using TS1 was similar with Malay Reading chart, 200 ± 30 wpm. Malay reading chart, namely UiTM-mrw was performed among young adult Malay-native speakers (Buari et al., 2014). However, the text structure in Malay reading chart was varied in terms of number of words ranges of 6 to 10 words per sentence. The construction of text structure controlled the lexical difficulty by using easy and simple related words from Malay school textbooks (Buari et al., 2014).

In comparison with previous study, reading speed using TS1 was found to be similar with some of standardised English reading chart, for example RRC. The mean reading speed of RRC was 201.5 ± 35.9 wpm (W Radner & Diendorfer, 2014). Factor that contributed in similarity of reading speed was because of the same age group of participants which both studies using young adult to read the sentences. Furthermore, the texts were constructed as comparable in number of words, words length, and number of syllables. The construction of RRC were controlled according to rule for sentence optotypes Radner Reading Test concept German language (W Radner & Diendorfer, 2014).

Young adult that read the TS2 showed the reading speed of 153.1 wpm. Reading speed with English language of IReST texts was 74.9 wpm faster than in this study using Malay language (Trauzettel-Klosinski & Dietz, 2012). This indicated that TS2 in Malay language were slower than IReST text with English language. The IReST had 141 words. This might be due to different in words construction even after the lexical difficulty using both languages was controlled. The total number of character in this study for TS2 was almost similar in IReST. The Malay language with TS2 had 678 characters while IReST have 664.5 characters (Trauzettel-Klosinski & Dietz, 2012). The structured TS2 need to consider the comprehension value for the readers even it was controlled in term of the number of words, words length, number of syllables, and lexical difficulty. Lexical and linguistic processing affected the attention during reading (Mishra, 2013). This study, the reading speed of 14 sentences of TS1 that constructed with 6 words was also found faster than in TS2. Total 14 sentences of TS1 comprised of 84 words where by the TS2 consisted of 100-words. The difference in numbers of word between TS1 and TS2 were 16 words. However, previous study

showed that the reading speed was highly correlated between TS1 than in TS2 in Italian. The TS1 consisted of 168 words while the TS2 187 words (Calossi et al., 2014). Previous study showed that the reading speed was significantly reduced among individual with vision impairment with 54±35 wpm (Mohammed & Omar, 2011). When the visually impaired patient read the reading chart, they read TS1. Theoretically, reading TS1 would increase the reading speed. However the reading speed was found lower among this population because of longer time was taken to read the text structure. This might be due to vision problem as the individual with vision impairment usually had ocular diseases and it would affect the clarity of ocular media and obstruction of viewing due to ocular pathologies (Ramulu, West, Munoz, Jampel & Friedman, 2009), (Legge et al., 1985).

Another factor that could affect reading speed when reading text structure of TS1 and TS2 were about controlling the numbers of characters and syllables. As number of words increase, reading speed became slower. This was supported by study from Wolfgang Radner and collegues (2002). The sentence that was developed in RRC consisted of 14 words in each sentence, which considered as TS1. The mean reading speed was 209.6 ± 41.0 wpm (Wolfgang Radner et al., 2002). The reading speed of RRC was then compared with ZRT. The ZRT consisted of 5 paragraphs with 261 words, considered as TS2. The mean reading speed of ZRT was 169 ± 35 wpm (Wolfgang Radner et al., 2002). This showed that the reading speed with RRC, TS1 were faster than ZRT, TS2. The finding was about similar in this study that reading the TS2 was slower than reading the TS1.

The reading speed of TS2 in Malay language was found lower than IReST approximately 228 words. In comparison with IReST, in this study, the TS2 consisted of 10 sentences while IReST had 8 sentences. However, the longest character of Malay word and IReST was about similar with 12 and 11 respectively. The same was found with lowest character which 2 and 1 character for Malay word and IReST. The difference might be due to language. The lexical difficulty might be one of the factors that gave different reading speed. Brussee and collegues (2015) compared five types of Dutch version of reading chart, which consisted of TS1 and TS2. Reading speed with more words using IReST texts, was 28 wpm faster than Nederlanders reading test, NED (Brussee et al., 2015). Both reading speed test was constructed as TS2. However, the reading speed of NED was slower than

IReST texts. This might be because of the construction of NED used high lexical difficulty compared to IReST texts which used the material of words between 4th grade to 6th grade. This might be indicated that even with TS2, differences in lexical difficulty could affect the reading speed.

CONCLUSION

Reading speed was different when reading between TS1 and TS2. This might be due to the arrangement of sentence either as single sentence or in a block arrangement. As the number of words increase per sentences, reading speed would be decrease. Reading speed was found slower in sentence with TS2 than TS1. The design of reading material need to consider the text structure for evaluating and monitoring reading and vision rehabilitation.

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